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High Frequency Acoustic Recording Package
Data Summary Report
PS06, January 30, 2009 – April 30, 2009

by
Tetyana Margolina

January 2011

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14. ABSTRACT This summary continues a series of reports on the project, which seeks to assemble a census of marine mammal vocalizations in the high-frequency acoustic recording package (HARP, Wiggins and Hildebrand, 2007) data collected by the NPS Oceanography Department off Point Sur beginning in October 2006. The present report provides an initial summary of marine mammal vocalizations detected and identified in records from the sixth HARP deployment between February 1, 2009 and April 30, 2009. Data was acquired in the 10 Hz – 100 kHz frequency band at a 200 kHz sampling frequency for 5 minutes during each 10 minute interval. Long-term spectral averages were created for three frequency bands (10 Hz–1000 Hz, 1 kHz–5 kHz, 5 kHz–100 kHz) and then scanned for marine mammal vocalizations. Detected calls of fin whales, humpback whales, as well as echolocations of sperm whales, beaked whales, and dolphins are presented as occurrence time diagrams.					
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ABSTRACT

This summary continues a series of reports on the project, which seeks to assemble a census of marine mammal vocalizations in the high-frequency acoustic recording package (HARP, Wiggins and Hildebrand, 2007) data collected by the NPS Oceanography Department off Point Sur beginning in October 2006. The present report provides an initial summary of marine mammal vocalizations detected and identified in records from the sixth HARP deployment between February 1, 2009 and April 30, 2009. Data was acquired in the 10 Hz – 100 kHz frequency band at a 200 kHz sampling frequency for 5 minutes during each 10 minute interval. Long-term spectral averages were created for three frequency bands (10 Hz–1000 Hz, 1 kHz–5 kHz, 5 kHz–100 kHz) and then scanned for marine mammal vocalizations. Detected calls of fin whales, humpback whales, as well as echolocations of sperm whales, beaked whales, and dolphins are presented as occurrence time diagrams.

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I. DATA

The PS06 HARP was deployed on top of Sur Ridge at $36^{\circ}23.332'N$, $122^{\circ}18.396'W$ on January 30, 2009 and recovered on April 30, 2009. The instrument location is shown in Fig. 1. Bottom depth at the deployment site was 836 m. A schematic diagram of the PS06 HARP mooring (courtesy of Ms. Marla Stone, Naval Postgraduate School) is given in Fig. 2. Temperature, salinity, and current data collected on the mooring have been described by Zamora (2009).

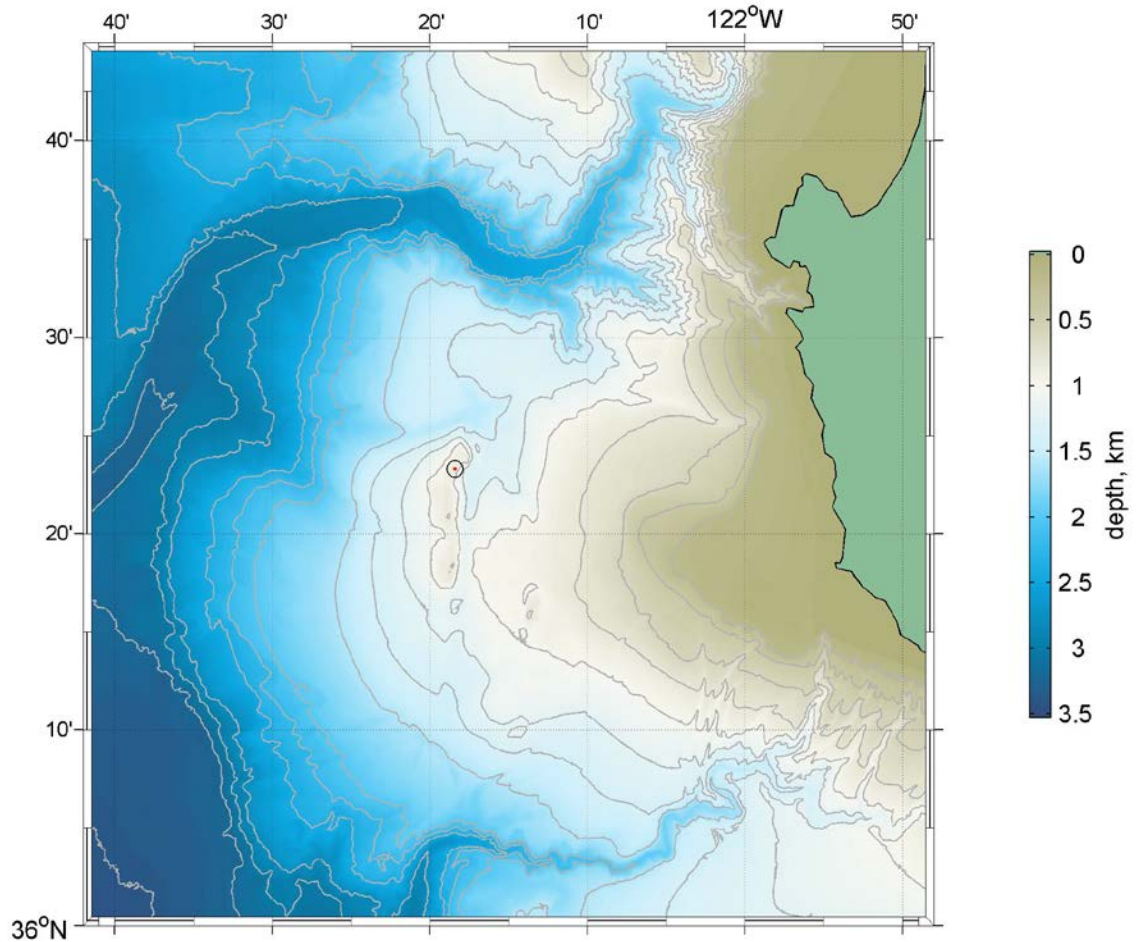


Figure 1. Chart showing PS06 HARP deployment location (red dot) to the west of Point Sur, California. The scale to the right indicates bottom depth in kilometers. Isobaths (gray lines) are shown at 200 m interval.

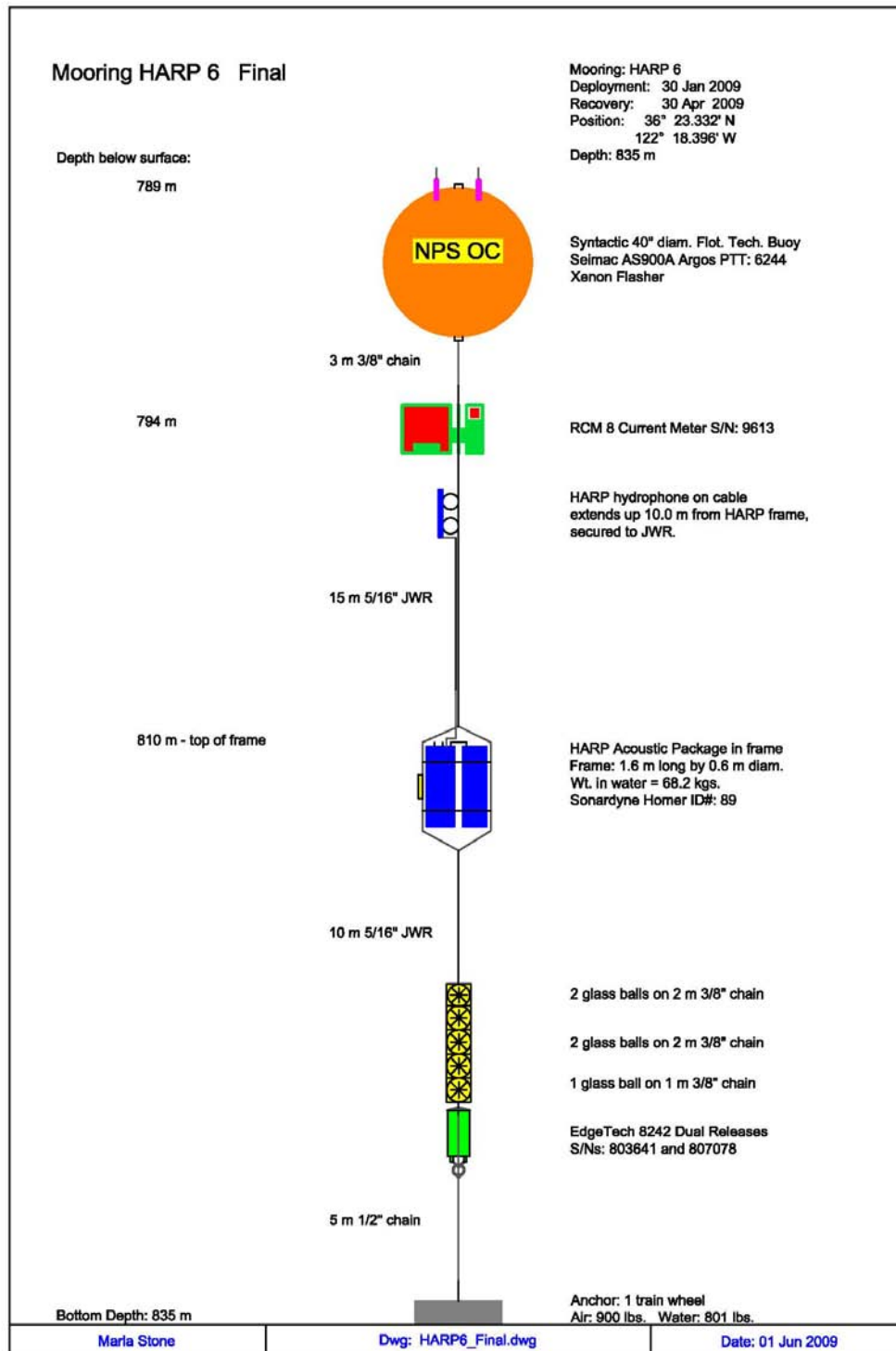


Figure 2. Schematic diagram showing details of the PS06 HARP. Note that objects and distances are not drawn to scale.

Data was acquired at a 200 kHz sampling frequency for 5 minutes during each ten minutes. There were timing errors on April 2-3, 2009. The PS06 HARP deployment provided a total of 1067 hours of data over the 90 days with recordings available from February 1 to April 30, 2009 (see Fig. 3).

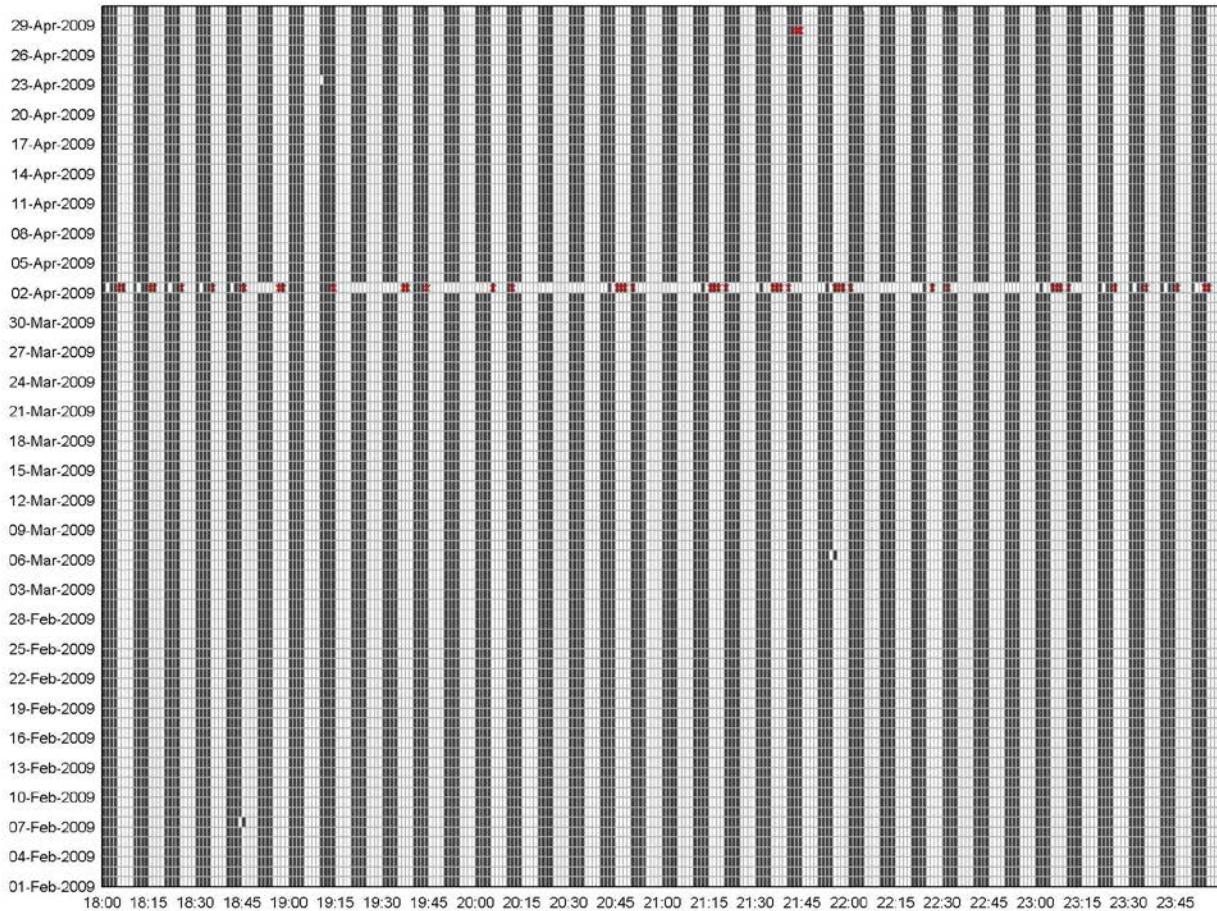


Figure 3. PS06 HARP schedule from 06:00:00 PM to 11:58:45 PM of each day.
Each cell corresponds to one raw file of 75 s duration.
Red crosses denote records of non-standard length.

The PS06 HARP data were manually scanned for marine mammal vocalizations using the “logger” version of the Scripps *Triton* software (v1.7b.20100426_loggers) as described in Technical report # NPS-OC-10-003 “High Frequency Automatic Recording Package Data Summary Report PS05, August 4, 2008 – January 6, 2009” (available online at <http://edocs.nps.edu/npspubs/scholarly/TR/2010/NPS-OC-10-003.pdf>).

II. RESULTS

Table 1 summarizes detected and identified marine mammal vocalizations for the PS06 HARP deployment. Figs. 4–10 illustrate occurrence time for different species and call types in 75 s bins.

No vocalizations of blue whales were detected in the PS06 records. This agrees with known patterns of blue whale migration and vocalization seasonality (e.g., see Burthernshaw, 2004) in the northeastern Pacific.

Observed fin whale calls were mostly 20 Hz, and were present almost exclusively in February 2009 (Fig. 4). This is also compliant with known seasonality of fin whale calling along the California coast, which usually peaks in midwinter (e.g., see Watkins et al., 2000).

Humpback whale vocalizations were nearly continually present in PS06 data in February – first half of March 2009, and more sparsely in April 2009 (Fig. 5).

Sperm whale clicks were evenly distributed From February, 2009 to April, 2009 (Fig. 6).

Detected dolphin vocalizations included echolocation clicks, whistles, and burst pulses (Figs. 7–9). Dolphins were present throughout the PS06 deployment, about 70% of them identified as Pacific white-sided dolphins, which intensified during night time from March to April (Fig. 7). Risso’s dolphins were detected during only 7 days: two in mid February and five in late March (Fig. 8).

Beaked whale vocalizations, albeit sparse, were present throughout the whole PS06 deployment from February to April, 2009 (Fig. 10). During three days (two in the first half of February and one in the second part of April) upswept clicks of ~20kHz peak frequency were identified. It is suggested that these echolocation clicks were produced by Baird’s beaked whales. Cuvier’s and Cuvier’s-like upswept echolocation pulses were identified in about 70% of total vocalization time.

Table 1. Summary of identified marine mammal vocalizations.

Species	Call type	Hours of vocalizations	Percentage of total recordings	Days with vocalizations	Percentage of total deployment duration
Fin whale	20 and 50 Hz	24	2%	8	9%
Humpback whale	various	245	23%	30	33%
Sperm whale	echolocation	179	17%	40	44%
Beaked whale	echolocation	27	3%	25	28%
Dolphins (total)	echolocation/ whistles	298	28%	83	92%
Risso's dolphin	echolocation	9	1%	7	8%
Pacific white-sided dolphin	echolocation/ whistles	205	19%	71	79%
Unidentified dolphin	echolocation/ whistles	83	8%	54	60%

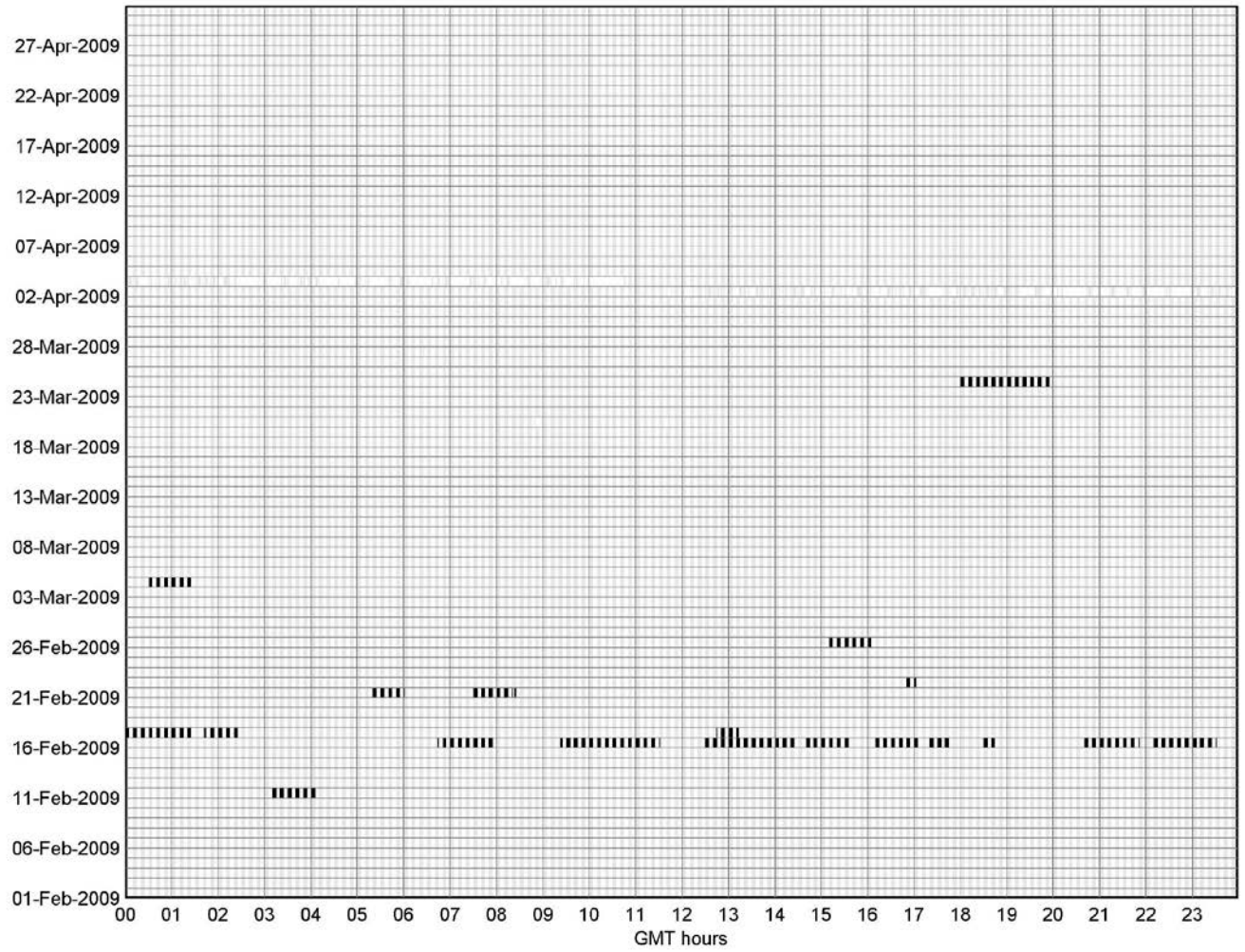


Figure 4. Fin whale calls in 75 s bins.

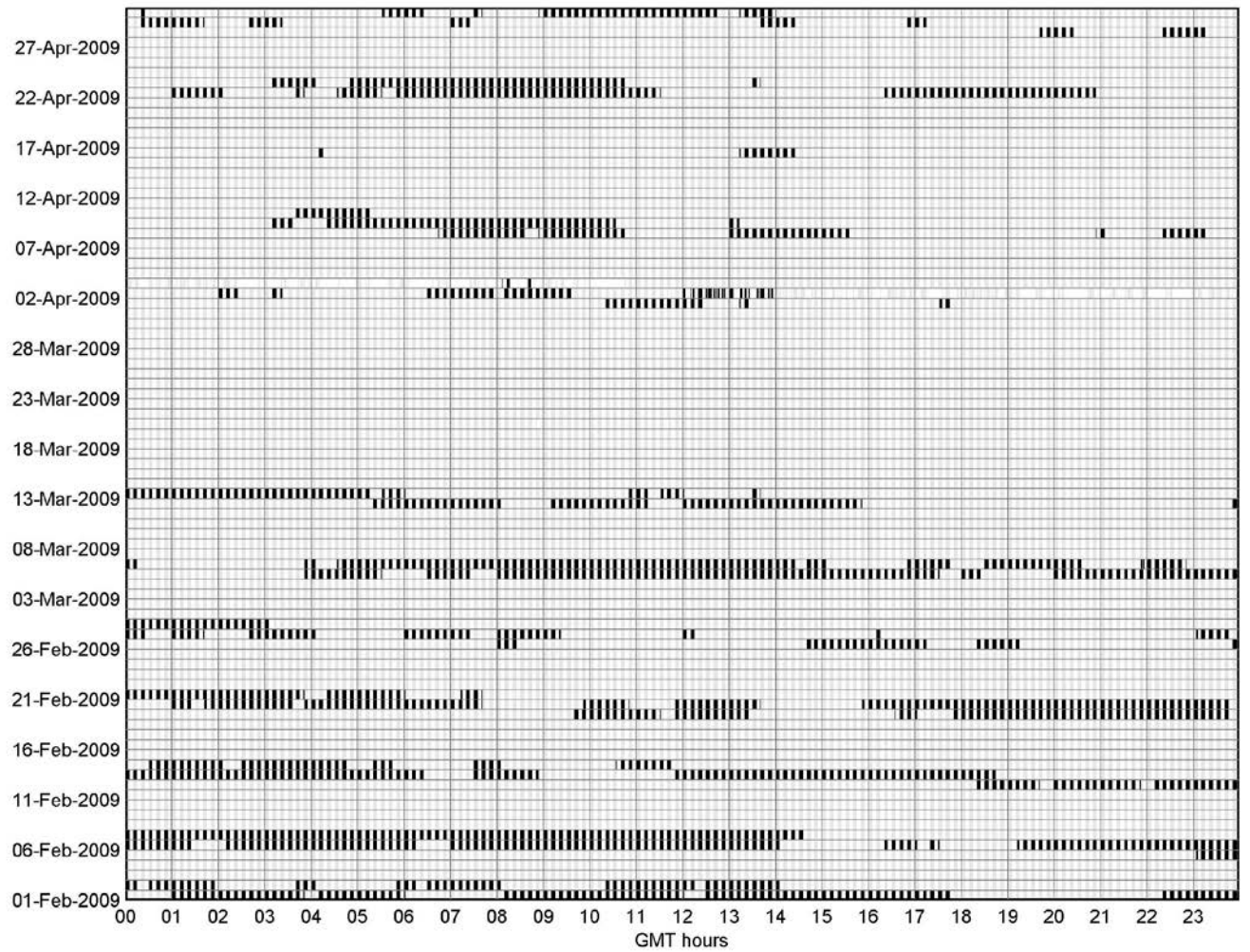


Figure 5. Humpback whale vocalizations in 75 s bins.

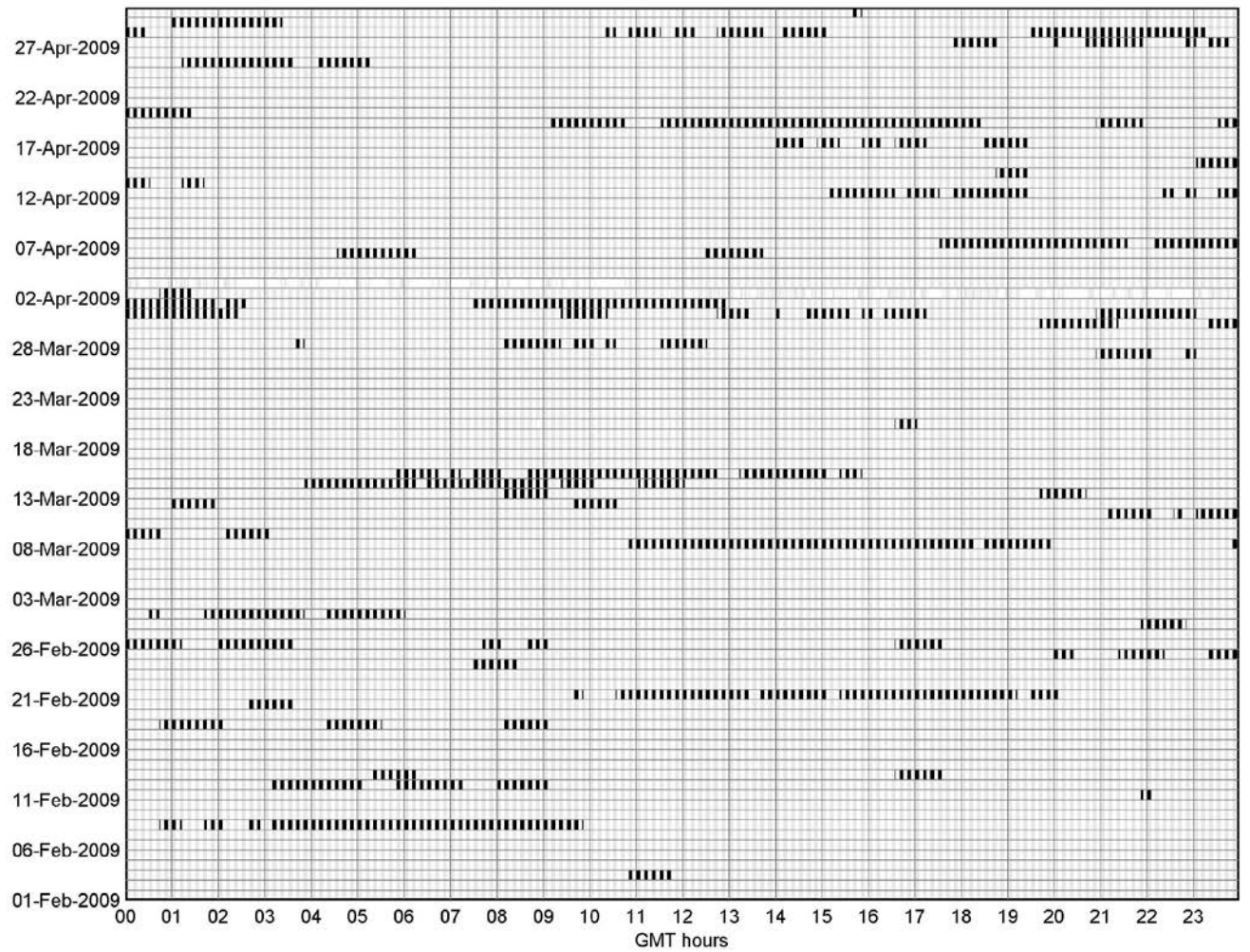


Figure 6. Sperm whale echolocation clicks in 75 s bins.

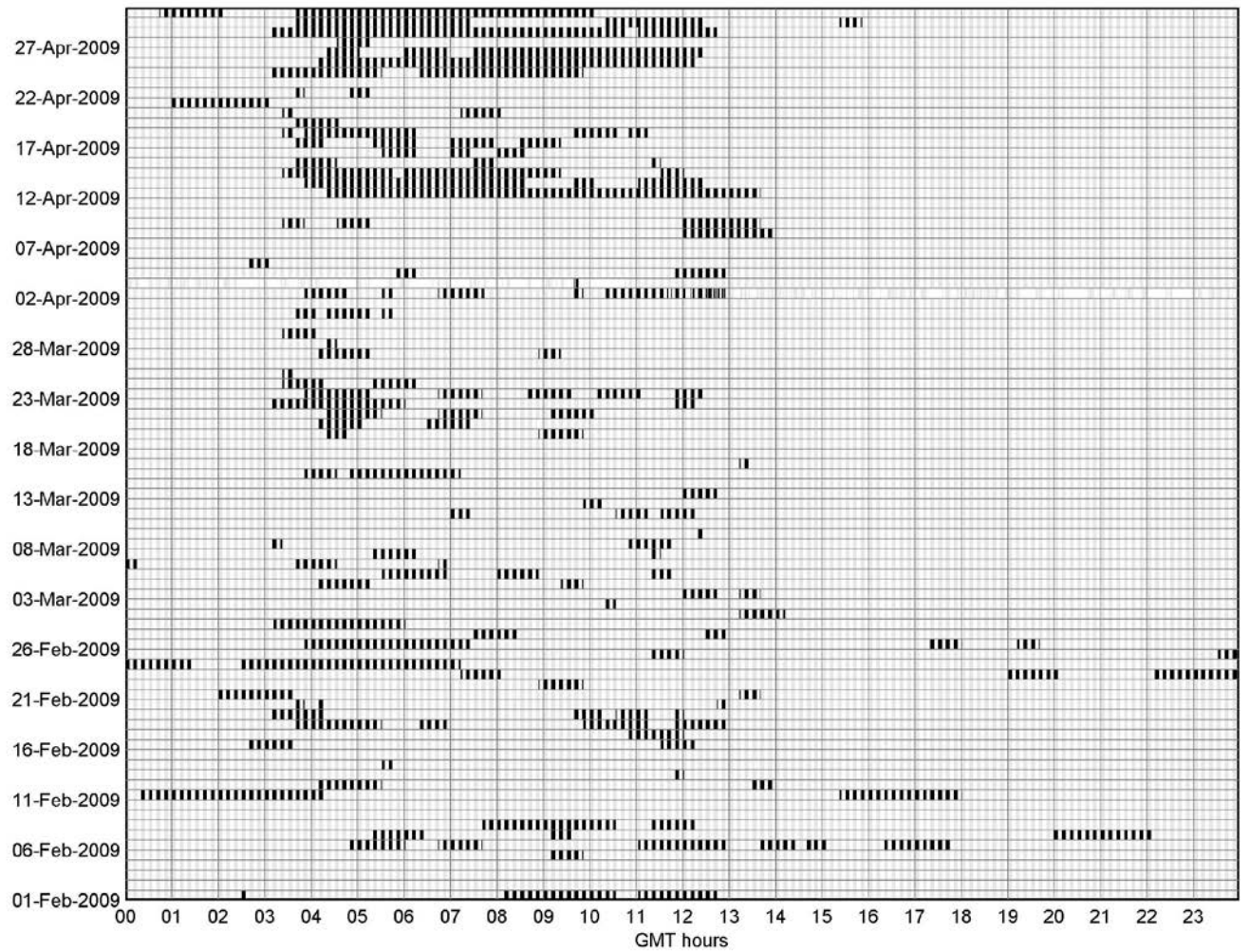


Figure 7. Echolocation clicks of Pacific white-sided dolphin in 75 s bins.

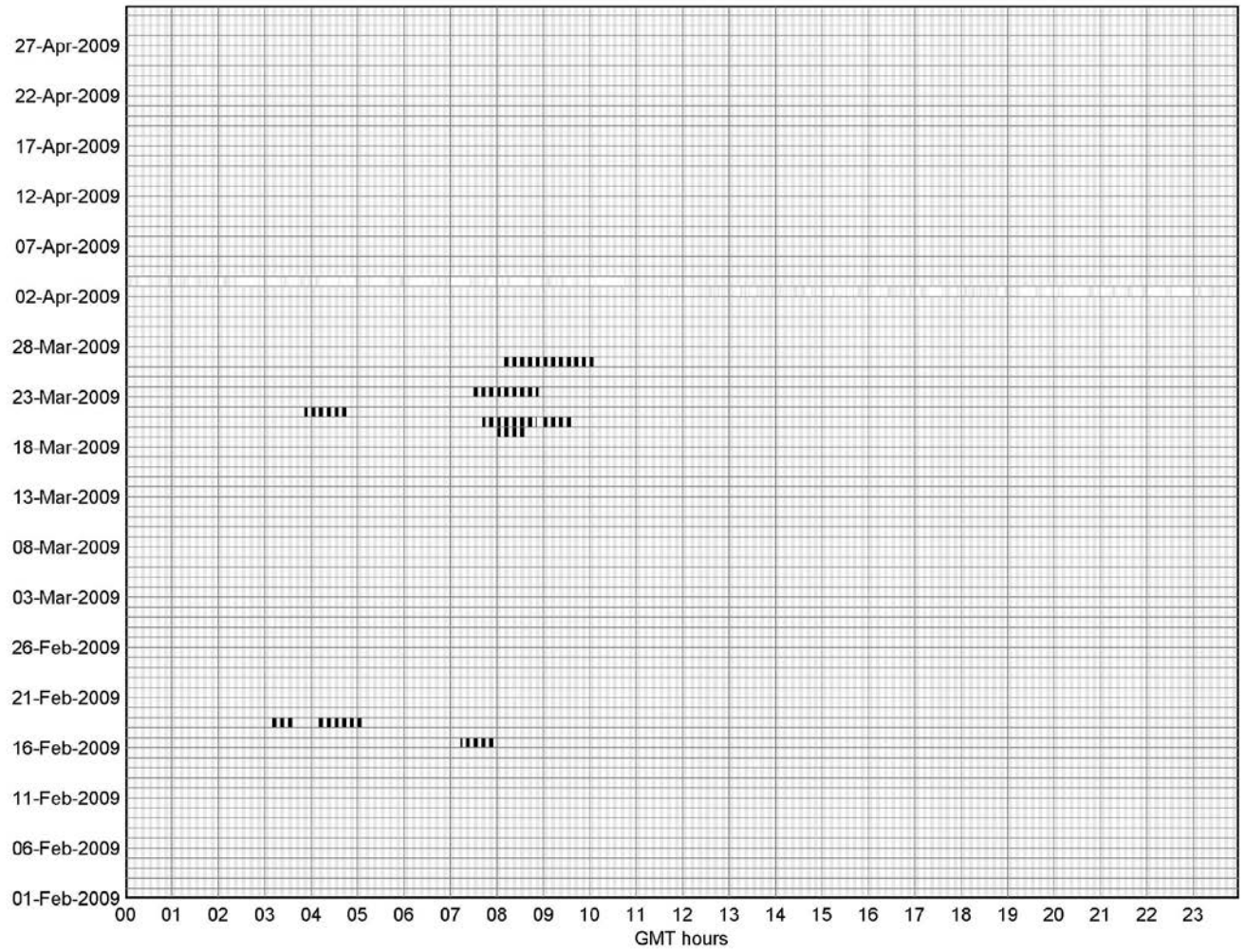


Figure 8. Risso's dolphin echolocation clicks in 75 s bins.

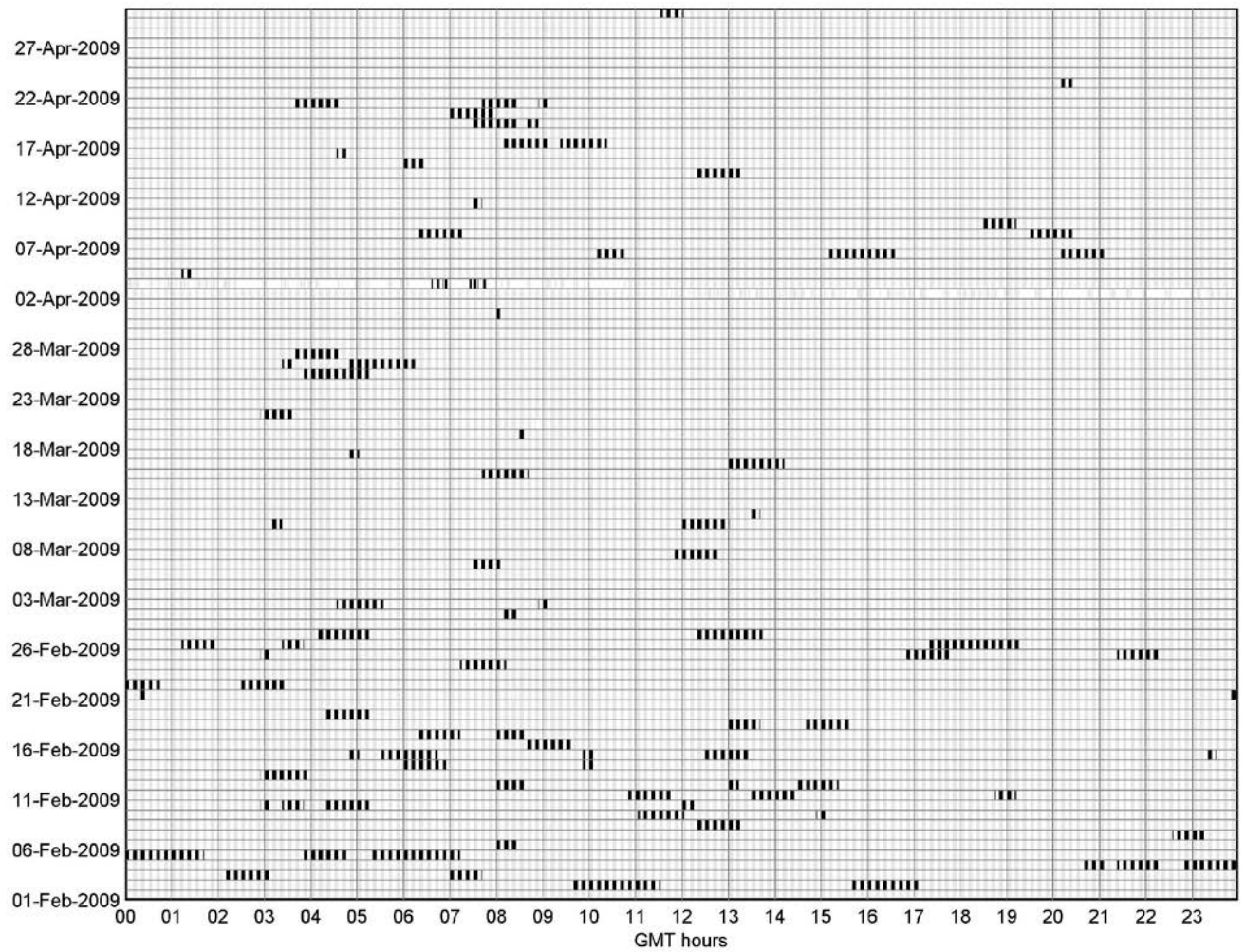


Figure 9. Echolocation clicks and whistles of unidentified dolphins in 75 s bins.

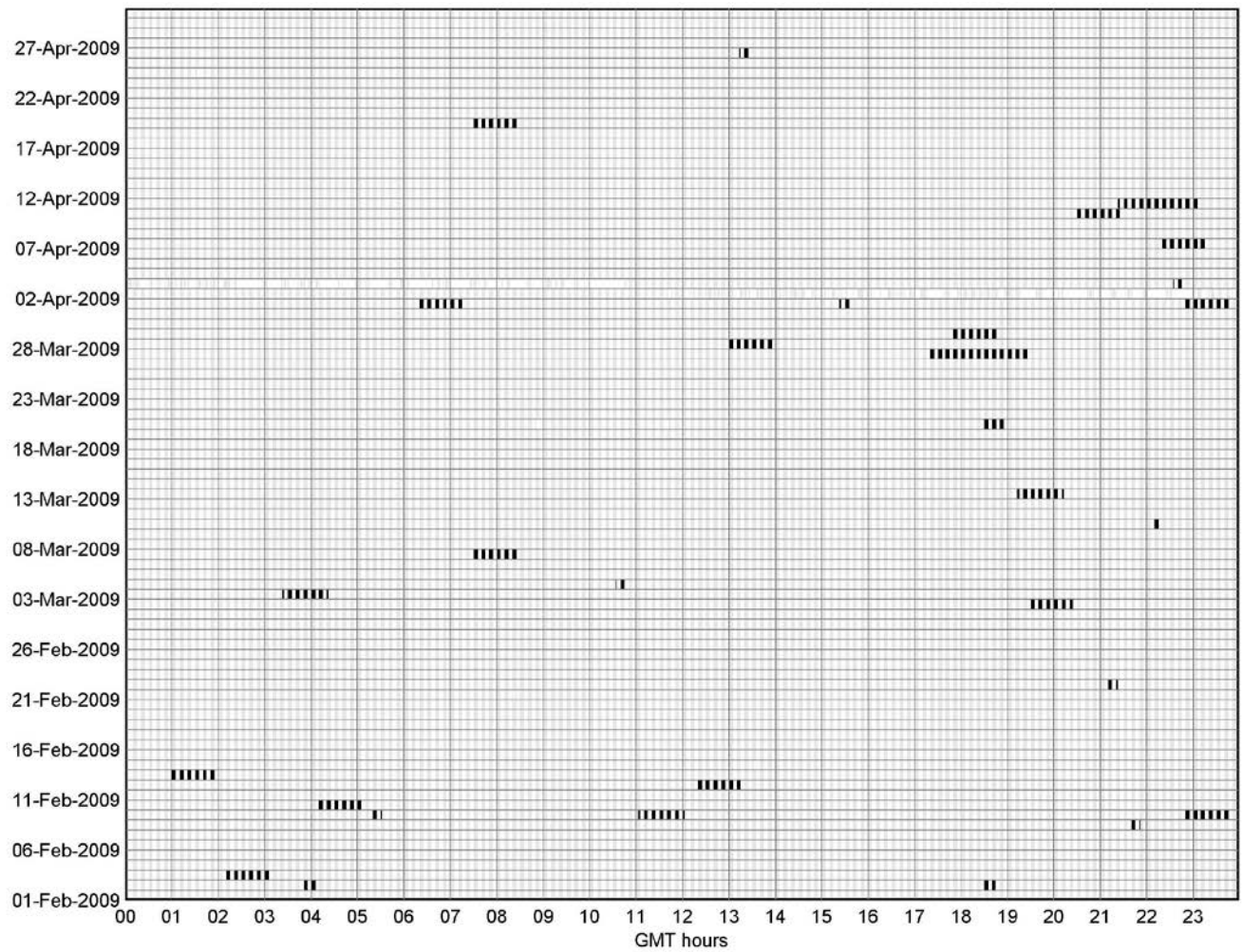


Figure 10. Beaked whale echolocation clicks in 75 s bins.

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